

# SKILL ENHANCEMENT COURSES

SYLLABUS FOR THE

## SUBJECT: ZOOLOGY

for the award of the Degree in

**BACHELOR OF ARTS/ BACHELOR OF SCIENCE/HONOURS**

(Offered under 4-year UG Degree Programme)

(Credit Based Grading System)  
under NEP 2020

**Batch: 2025–29**



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## GURU NANAK DEV UNIVERSITY AMRITSAR

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Skill Enhancement Courses in Zoology  
(CBGS) (under NEP 2020) (Batch 2025-29)

**SCHEME**

**SKILL ENHANCEMENT COURSES**

**ZOOLOGY**

**SEC-I**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits L-T-P</b>	<b>Marks</b>
1.		AQUACULTURE (THEORY)	2-0-0	50
2.		AQUACULTURE LAB (PRACTICAL)	0-0-1	25
<b>OR</b>				
3.		VERMITECHNOLOGY (THEORY)	2-0-0	50
4.		VERMITECHNOLOGY LAB (PRACTICAL)	0-0-1	25

**SEC-II**

<b>Sr. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits L-T-P</b>	<b>Marks</b>
1.		APICULTURE (THEORY)	2-0-0	50
2.		APICULTURE LAB (PRACTICAL)	0-0-1	25

**SEC-III**

<b>Sr. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Credits L-T-P</b>	<b>Marks</b>
1.		MEDICAL LAB TECHNOLOGY (THEORY)	2-0-0	50
2.		MEDICAL LAB TECHNOLOGY LAB (PRACTICAL)	0-0-1	25

**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-I)**  
**AQUACULTURE**  
**(THEORY)**

**Time: 3 Hrs.**

**L-T-P**  
**Credits: 2-0-0**  
**Marks: 50**  
**30 Hrs.**

**Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**SECTION-A**

**Morphology of fish** (carp, cat-fish, freshwater eel, perch).

**Exotic fishes:** Introduction, important species, their role in fish culture, impact on fish fauna

**SECTION-B**

**Culture Systems:** Conventional, Extensive, Intensive, Monoculture and Poly culture, cage culture.

Integrated fish farming (with Duckry, poultry, piggery, dairy and paddy).

Sewage fed fishery.

**SECTION-C**

**Pond culture:** Construction of pond, Types of pond, Management of pond (Pre-stocking, stocking and post stocking).

**Induced Breeding** of fish (Methodology and impact on fish culture).

**SECTION-D**

**Important Diseases** (Viral, Bacterial, Fungal, Helminthes, Crustacean) and their control.

Fish products and by-products.

Marketing of Fish and Preservation of fish.

**Course Outcome:** With this course, the students will be able to define, comprehend, scope and significance of aquaculture. They will examine the types and practices of Aquaculture.

**Suggested Readings:**

1. Aggarwal S.C. & Johal M.S., Fishery Development, Narendra Publishing House, Delhi.
2. Jayaram, K. C. (1981), the freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka-A Hand Book of Zoological Survey of India, Kolkatta.
3. Jhingran V. G. (1991), Fish and Fisheries of India, Hindustan Publishing Corporation of India, Delhi.
4. Johal M.S. & Tandon K.K. (1979, 1980), Monograph on the Fishes of reorganized Punjab, (Vol. I & II), Punjab.
5. Johal M.S. & Tandon K.K.(1981), Fisheries of Punjab, Res. Bull, Panjab University, Vol. 32, pp. 143-154.
6. Legler Karl F (1962), Freshwater Fishery Biology, Wm. C-Brown Co. Dublingus IOWA, USA.
7. Munshi, J.S.D and Datta, H.M. (1996), Fish Morphology- Horizons of New Research, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Rath R.K. (1993), Freshwater Aquaculture, Scientific Publishers, Jodhpur.
9. Tandon K.K. and Johal M.S. (1996), Age and Growth of freshwater fishes in India, Narendra Publishing House, New Delhi.

**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-I)**  
**AQUACULTURE LAB**  
**(PRACTICAL)**

**Time: 2 Hrs.**

**L-T-P**  
**Credits : 0-0-1**  
**Marks: 25**  
**30 Hrs.**

**Important Note for Practical:-**

1. Candidates will be required to submit their original note books containing record of their laboratory work.
2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
3. As per the latest UGC guidelines (D.O.No. F. 14-6/2014 (CPP-II) dated 01-08-2014) the dissections should not be conducted. The guidelines on this issue are available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)
1. Morphology of a Carp, Cat fish and Perch.
2. Identification of the following fishes using key : *Notopterus* spp.; *Labeo rohita*, *L. bata*, *Cirrhinus mrigala*, *Catla catla*, *Puntius sarana*, *Tor putitora*, *Schizothorex*, *Aorichthys seenghala*, *Wallago attu*, *Callichrous padda*, *Bagarius bagarius*, *Heterpneustus fossilis*, *Channa marulius*, *C. Striatus*, *Xenotodon cancila*, *Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*, *Colisa fasciata* and *Mastacembelus armatus*.  
For the identification of these fishes, the candidate can use already prepared keys or they can prepare their own keys.
3. Determination of feeding habits of the fish from the position of mouth.
4. To observe the seasonal changes in the gonads during different phases of the reproductive cycle.
5. Identification of aquatic weeds of a fish pond.
6. Estimation of following physico-chemical parameters of pond water :
  1. Temperature
  2. pH
  3. Dissolved oxygen
  4. Phosphates
  5. Total Dissolved solids
  6. Nitrates
  7. Hardness
  8. Examination of diseased fishes
7. Visit of fish farm and preparation of report.

**Note:- Some changes can be made in the practicals depending on the availability of material.**

<p><b>Course Outcome:</b> The learners will be aware of all the techniques involved in aquaculture.</p>
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**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-I)**  
**VERMITECHNOLOGY**  
**(THEORY)**

**Time: 3 Hrs.**

**L-T-P**  
**Credits: 2-0-0**  
**Marks: 50**

**Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**Course Outcome:** Students will learn about habit, habitat and handling of earthworms. They will also learn about biosafe disposal of organic waste and its use in agriculture/industry.

**SECTION-A**

**Biology of Earthworm:** Classification, habit, habitat, morphology, body cavity (coelom), structure & physiology of digestive system and reproductive systems, Life cycle of earthworm

**SECTION-B**

**Vermiculture:** Concept, its extensive and intensive culture, Factors affecting earthworm, Four R's of recycling, reduce, reuse, restore.

Feed for earthworm. Pharmaceutical from earthworms. Life cycle of earthworm.

Useful species of earthworms: Selection of suitable species local and exotic species of earthworms

**SECTION-C**

**Vermicomposting:** Material required, Vermicomposting pots, Types of shed, Bed preparation, Tools for vermicomposting, Types of organic wastes, Preliminary treatment of the material. Composition of vermicompost. Inoculation of earthworms, Precautions and best practices, Harvesting, processing, Vermiwash, Benefits and uses of vermicompost. Different Methods of Vermicomposting: Small- and large-scale vermicomposting, Pit method.

**SECTION-D**

**Problems in vermicomposting:** Pests and diseases of earthworms, Frequent problems and preventive methods, Economics of vermiculture and entrepreneurship. of vermicompost, Composition of vermicompost, Role in maintenance of soil structure.

**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-I)**  
**VERMITECHNOLOGY LAB**  
**(PRACTICAL)**

**Time: 2 Hrs.**

**L-T-P**  
**Credits : 0-0-1**  
**Marks: 25**

1. Study of Vermiculture, Vermiwash & Vermicompost equipments.
2. Identification of useful species of earthworms.
3. Study of Life stages & development of *Eiseniafetida* and *Eudriluseugeniae*.
4. Comparison of the performance of local and exotic species of earthworms.
5. Comparison of the efficiency of vermicomposting methods: Bed Method and Pit Method.
6. Vermiculture Harvest of worms, vermiwash and vermicompost
7. Field trip/project report.

**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-II)**  
**APICULTURE**  
**(THEORY)**

**Time: 3 Hrs.**

**L-T-P**  
**Credits: 2-0-0**  
**Marks: 50**  
**30 Hrs.**

**Instructions for the Paper Setters:-**

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

**SECTION-A**

**Biology of Bees** - History, classification and types. Different castes of bee colony.

**SECTION-B**

**Rearing of Bees.** Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth type.

Bee Pasturage, selection of bee species for Apiculture.

Methods of Extraction of Honey (Indigenous and Modern).

**SECTION-C**

**Diseases and Enemies** - Bee diseases and enemies. Control and preventive measures.

**Bee Economy** - Products of Apiculture, Industry and its Uses (Honey, Bees Wax, Propolis), Pollination.

**SECTION-D**

**Entrepreneurship in Apiculture:** Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.

<p><b>Course Outcome:</b> The course provides the knowledge about honey bee and bee keeping. Beekeeping can also provide an important source of income for many rural livelihoods.</p>
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**Suggested Readings**

1. Dewey M. Caron, 2013. Honey Bee Biology and Beekeeping, Revised Edition. Wicwas Press, Kalamazoo.
2. Jaiswal . A.G. (2019). Practical Handbook on Apiculture. Lulu Publication, United State.
3. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
4. Bisht D.S., Apiculture, ICAR Publication.
5. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.
6. Ghosh, G.K. (1994). Bee Keeping in India. Ashish Publishing House, New Delhi.

**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-II)**  
**APICULTURE LAB**  
**(PRACTICAL)**

**Time: 2 Hrs.**

**L-T-P**  
**Credits : 0-0-1**  
**Marks: 25**  
**30 Hrs.**

**Important Note for Practical:-**

1. Candidates will be required to submit their original note books containing record of their laboratory work.
  2. Wherever possible, students must be taken out for excursion to the field (Zoological gardens, sea shores, ponds and hill stations etc.) to study habitat and ecology of the animals.
  3. As per the latest UGC guidelines (D.O.No. F. 14-6/2014 (CPP-II) dated 01-08-2014) the dissections should not be conducted. The guidelines on this issue are available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)
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1. To study various types of equipment's used in modern bee farming (Frames, comb foundation mill, veil, smokers, uncapping knife, hive tools, queen cage, queen protector cell, bee brush, feeders, honey extractor, wax melter, pollen trap)
  2. To study different types of Bee Hives (Newton hive, Langstroth hive)
  3. To study different species of honeybees through photographs.
  4. A visit to an Apiary and preparation of report.

**Note:- Some changes can be made in the practicals depending on the availability of material.**

**Course Outcome:** The course provides the knowledge about honey bee and bee keeping. Beekeeping can also provide an important source of income for many rural livelihoods.

**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-III)**  
**MEDICAL LAB TECHNOLOGY**  
**(THEORY)**

**Time: 3 Hrs.**

**L-T-P**  
**Credits: 2-0-0**  
**Marks: 50**  
**30 Hrs.**

**Instructions for the Paper Setters:-**

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**SECTION-A**

Antigen and antibody interactions- Serodiagnostic assays (Precipitation, agglutination immunodiffusion, ELISA, RIA)

Vaccines

Laboratory Techniques: Colorimetry, Microscopy, Autoclaving, Centrifugation and Spectrophotometry

**SECTION-B**

Collection, transportation and preservation of different clinical samples.

Haematology, collection of blood (venous and capillary), anticoagulants (merits and demerits), Romanowsky's stains, total RBC count, erythrocyte sedimentation rate, TLC, DLC, platelet count

**SECTION-C**

Bacteriology: sterilization (dry heat, moist heat, autoclave, filtration), disinfection, staining techniques, (gram stain, AFB stain, etc), culture media (defined and synthetic media & routine laboratory media), bacterial culture (aerobic and anerobic) and antibiotic sensitivity.

**SECTION-D**

Histopathology: Common fixatives and staining techniques.

Biochemistry: Principal/theory and significance of estimation of urea, sugar, cholesterol, creatinine, enzymes (transaminase, phosphatase, amylase and lipase), uric acid in blood, estimation of proteins, sugar, bile salts, ketone bodies in urine and liver function test.

**Course Outcome:** The students will be prepared and proficient in skills that are necessary for them to function as part of the healthcare team, recognizing the responsibilities of other laboratory and health care personnel and interacting with them with respect for their jobs and patient care.

**Suggested Readings:**

1. Baker, F.J. and Silverton, R.E. (1985) Introduction to Medical Laboratory Technology, (6<sup>th</sup> ed), Butlerworth and Co. Ltd.
2. Chatterjee, K.D. (1995), Parasitology, Protozoology and Helminthology (12<sup>th</sup> ed).
3. Cheesborough, M. (1987), Medical Laboratory Technology for Tropical countries (2<sup>nd</sup> ed), Butlerworth and Co., Ltd.
4. Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4<sup>th</sup> ed), ASM Press Washington.
5. Kimball, J.W. (1986), Introduction of Immunology, MacMillian Publishing Co., New York.
6. Kuby, J. (2000), Immunology, W.H. Freeman & Co., USA.
7. Roitt, I. (1984), Essential Immunology, Blackwell Scientific Publications, Oxford.
8. Talib, V.H. (1999), Essential Laboratory Manual, Mehta Publishers, New Delhi.

**ZOOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(SEC-III)**  
**MEDICAL LAB TECHNOLOGY LAB**  
**(PRACTICAL)**

**Time: 2 Hrs.**

**L-T-P**  
**Credits : 0-0-1**  
**Marks: 25**  
**30 Hrs.**

**Important Note for Practical:**

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3. As per the latest UGC guidelines (D.O.No. F. 14-6/2014 (CPP-II) dated 01-08-2014) the dissections should not be conducted. The guidelines on this issue are available on the UGC website: [www.ugc.ac.in](http://www.ugc.ac.in)
1. Demonstration of safety rules in laboratory like proper handling of patients, specimens and disposal of syringes, needles etc.
2. Demonstration of the use of autoclave, centrifuge and spectrophotometer.
3. Cleaning and sterilization of glass ware, using hot air oven, autoclave etc.
4. Physico-chemical examination of urine.
5. Preparation of thick and thin blood smear.
6. Counting of WBC, RBC and DLC.
7. ESR and haematocrit

Demonstration of fixation, embedding, cutting of tissue sections, and their staining (routine haemotoxylin and eosin).

Visit to a pathology Lab and preparation of report.

**Note:- Some changes can be made in the practicals depending on the availability of material.**

**Course Outcome:** The students can apply knowledge and technical skills associated with medical laboratory technology for delivering quality clinical investigations support.